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06-AMCP-0146

MAR 16 2006

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Addressees:

ANNUAL LETTER REPORT FOR TRITIUM TREATMENT TECHNOLOGY DEVELOPMENTS - MARCH 2006

This annual letter report provides an update on the development of tritium treatment technology that would be pertinent to the cleanup and management of tritiated wastewater (e.g., the 242-A Evaporator, process condensate, liquid effluent) and tritium contaminated groundwater at the Hanford Site.

Tri-Party Agreement milestone M-026-07 requires the submittal of a formal evaluation of the development status of tritium treatment technology every five years. The first formal tritium technology evaluation report submitted under this milestone was transmitted to EPA and Ecology in March 2004. Other tritium technology evaluation reports, identified below, were previously submitted as required by Tri-Party Agreement milestone M-026-05, which was replaced by milestone M-026-07.

In accordance with Tri-Party Agreement milestone M-026-07, the next formal tritium technology evaluation report is due on March 31, 2009. Each year that a formal report is not due, an annual letter report is to be submitted to the regulators. This letter is the second annual letter report submitted.

Tritium technology evaluation reports that have been developed to date are listed below.

- Tritiated Wastewater Treatment and Disposal Evaluation for 1994, DOE/RL-94-77
- Tritiated Wastewater Treatment and Disposal Evaluation for 1995, DOE/RL-95-68

- 1997 Evaluation of Tritium Removal and Mitigation Technologies For Wastewater Treatment, DOE/RL-97-54
- 1999 Evaluation of Tritium Removal and Mitigation Technologies For Wastewater Treatment, DOE/RL-99-42
- 2001 Evaluation of Tritium Removal and Mitigation Technologies For Wastewater Treatment, DOE/RL-2001-33
- 2004 Evaluation of Tritium Removal and Mitigation Technologies For Wastewater Treatment, DOE/RL-2004-11

The above reports each evaluated the applicability of tritium removal and mitigation technologies to Hanford Site groundwater and wastewater applications. Technologies were evaluated for applicability to large wastewater volumes with relatively low levels of tritium (less than 1.0E-05 Ci/L) as seen in Hanford wastewaters and groundwater. Technology applicability to smaller wastewater volumes with higher levels of tritium (greater than 1.0E-05 Ci/L) was also identified.

The attached Table 1, updated to include the 2004 tritium report, summarizes the technologies discussed in each report, indicates technology maturity, and defines technology applicability.

The majority of tritium removal technology development has been conducted with wastewaters containing tritium at levels higher than expected in the Hanford wastewaters or observed in Hanford groundwater. However, as can be seen on Table 1, there are several fairly developed technologies (designed with a D) that are designated as being applicable to wastewaters having less than 1.0E-05 Ci/L of tritium.

- Soil column discharge
- Barrier formation
- Pumping and recharging
- Phytoremediation
- Evaporation

Both soil column and barrier formation concepts have been implemented via use of the State-approved land disposal structure for treated effluent disposal. Other technologies, pumping/recharging, phytoremediation, and evaporation, even though applicable to low levels of tritium, cannot reasonably be applied on the scale required to address Hanford groundwater tritium contamination.

None of the other technologies identified to date are currently viable for treating the large volumes of Hanford wastewater and groundwater having relatively low concentrations of tritium. Many of the developed technologies depend on an energy-intensive phase transfer process (e.g., changing a liquid to a gas) or pretreatment of the tritiated water to remove dissolved solids and would not be cost-effective to implement.

Emerging tritium removal technologies that do not depend on a phase transfer or dissolved solid removal have been slow to mature due to funding limitations, inadequacies defined during field

demonstration, and the lack of commercial demand for tritium removal technologies applicable to tritium levels less than 1.0E-05 Ci/L.

The tritium technology reports developed to date have concluded that tritium removal technologies are not economically viable for the large volumes of Hanford wastewaters and groundwater with relatively low tritium concentration (less than 1.0E-05 Ci/L). A review of literature produced since the issuance of the March 2004 report did not identify any information that would change this conclusion. Recent technologies in tritium separation, however, can be found in the Journal of Fusion Science and Technology, Volume 48, Number 1 (July/August 2005). One noteworthy advancement was made using a palladium membrane reactor (PMR), which was recently designed, constructed, and put into service at the Savannah River Site. Although small, for large low-concentration wastewater volumes at Hanford, this PMR system is the first known "large-scale" application of routine, production recovery of tritium from tritiated water.

If you have any questions, please contact Matt McCormick, Assistant Manager for the Central Plateau, on (509) 373-9971, or Joel Hebdon, Environmental Services Division, on (509) 372-3468, for regulatory issues.

Sincerely,

Betty L. Hollmes

for Keith A. Klein
Manager

AMCP:OMH

Attachment: Table 1

cc w/attach:
G. Bohnee, NPT
K. A. Conaway, Ecology
L. J. Cusack, Ecology
L. D. Gadbois, EPA
S. Harris, CTUIR
R. Jim, YN
T. M. Martin, HAB
K. Niles, ODOE
Administrative Record, H6-08
Environmental Portal

cc w/o attach:
D. L. Flyckt, FHI
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TABLE 1
Summary of Tritium Removal and Mitigation Technologies

Technology	Year Report Prepared					
	1994	1995	1997	1999	2001	2004
Distillation	D, h		D, h	D, h	D, h	D, h
Gaseous diffusion	D, h					
Laser isotope separation	T, h	T, h	T, h			
Electrolysis	D, h	D, h	D, h			
Combined electrolysis and catalytic exchange (CECE)	D, h	D, h T, I	D, h T, I	D, h T, I	D, h T, I	D, h T, I
Combined electrolysis catalytic exchange with vapor phase catalytic exchange					D, h	
Membrame separation process	T, I	T, I	T, I			
Cryogenic distillation	D, h	D, h	D, h	D, h	D, h	
Bithermal catalytic exchange		D, h T, I		D, h T, I	D, h T, I	D, h T, I
Isotopic exchange, air sparge		T, I				
Finely divided nickel catalyst		O				
Separation by Metanetix Inc.		O				
Substituted naphthalene		O				
Crown Ether Complexes		O				
Girdler-sulfide Process			D, h	D, h	D, h	D, h
Liquid phase catalytic exchange with solid oxide electrolysis			D, h	D, h T, I	D, h T, I	
Liquid phase catalytic exchange with high-temperature steam electrolysis (Hot Elly)			D, h			
Sulfer resin ion exchange			O			
Metal hydride exchange			T, h			
Soil column discharge	D, I, h		D, I, h	D, I, h	D, I, h	D, I, h
Barrier formation			O	D, I, h	D, I, h	D, I, h
Air sparging			T, I			
Dual-temperature liquid-phase catalytic exchange				D, h		
Tritium resin separation process				T, I	T, I	T, I
Kinetic-isotope effect for concentrating tritium				T, I	T, I	
Pumping and recharging				D, I	D, I	D, I
Phytoremediation					D, I	D, I
Evaporation						D, I

Maturity:

D = Demonstrated or developed technology that has been successfully applied in the field
T = Testing or theoretical stage of development
O = Observation indicates a potential process needing funding to continue

Applicability:

I = Technology is applicable to large wastewater volumes having lower levels of tritium (less than 1.0E-05 Ci/L)
h = Technology is applicable to smaller wastewater volumes having higher levels of tritium (greater than 1.0E-05 Ci/L)